Content Creation

1. **Data Organization**
   - Categories of Data
     - You can create more directories than just the six main ones
       - Astronomy, Atmosphere, Land, Models and Simulations, Oceans, Extras
     - We recommend creating a "proto" or "prototype" directory where you can store new and experimental dataset
       - Changes made in the main six categories could potentially be overwritten during data updates, but the proto folder won't change
   - Datasets are organized into folders
     - A dataset folder contains all of the information required to play the visualization on the sphere:
       - ECE images or MP4 files
       - playlist.sos
       - PIP's, audio files, labels and more
     - A minimal dataset folder will contain:
       - ECE images of MP4 files
       - playlist.sos
     - The other pieces are optional, but can add valuable information if available

2. **Data Formats for SOS**
   - Types of Datasets
     - Textures
       - Single, static image that can rotate on the sphere (PNG, JPG, TIF …)
       - Rotation rate is adjustable by setting the frames per second (fps) in the playlist.sos file
     - Time Series
       - Series of images with no limit on the number of images (can also be MPEG4)
       - When making a time series, keep the frame rate in mind to ensure that you make enough images
       - The frame rate is limited by the pixel resolution of the data and the type of data
   - Best Data Formats
     - The SOS software can support most common images files such as GIF, JPEG, PNG, TIF, etc.
     - We prefer JPEG or PNG, though if you are layering the data you must use PNG
     - MPEG4 is our preferred format for times series animations
     - MPEG4 gives the best playback performance and generally the smallest file size

- In order for the data to wrap properly around the sphere it is imperative that you follow the specifications for the data closely.

- ECE Projection
  - All of the images and videos must be in Equatorial Cylindrical Equidistant (ECE) projection
  - This is also known as the lat/lon grid
  - ECE is a standard cartographic map projection where the dimensions of the image are a rectangle that is twice as wide as it is tall
  - Images in any projection will project, but they will not necessarily wrap correctly on the sphere or look good
  - The data must fill the entire ECE image, there can be no borders or edges in the image.
  - The borders and edges cause seams to appear on the sphere with spots at the poles
  - Images should at a minimum be 2048x1024 and preferably 4096x2048
- Layering Data
  - A great way to save disk space when creating a time series is to use layered data
  - You must use PNG's in order to use layered data because they allow for images to have transparency
  - All you need is one background image and then a series of transparent images that contain just the data
- File Naming Conventions
  - Single images for textures are named for their size, such as 4096.jpg
  - Series of images are all kept in one folder named for the size of the images
  - The images in a time series should sort in ascending order from earliest to latest
  - To do this, we usually embed a frame number in the image file name with a sufficient number of leading zeros to sort correctly
- System Interactions with Data
  - When a dataset is projected on the sphere you are really looking at four images that have been merged together seamlessly around the sphere
  - The SOS software splits the ECE images into four disk images
  - This happens automatically every time you load an image on the sphere using the SOS Stream GUI
  - You don't need to do anything but create playlists to point to the data that you want to use
- Tools to Create Datasets
  - Because Science On a Sphere® uses common image formats, you can use many tools to create and edit datasets such as:
    - Photoshop
    - ImageMagick
    - GIMP
    - FinalCut Pro

- Tools like IDL, AWIPS, McIDAS, and other image analysis applications are typically used to create imagery from scientific datasets
- 3D modeling applications, such as 3D Studio, can be used to create advanced visualizations

3. **Animation Options in playlist.sos** http://sos.noaa.gov/support/playlist_edit.html
   - Frame Rate
     - The optimal playback speed is chosen based on the number of animation frames and the degree of change between each frame in the sequence
     - To get smooth animations the changes between each frame should be small and the playback speed high
     - We typically try to create data so that they look smooth and animate well at 30 fps
     - If a dataset is coarse, then they might look better animated at a lower rates (10 – 15 fps)
   - Animate
     - When the dataset is initially loaded it can immediately start to animate or stay stationary until play is pressed
       - animate = 0 (rotate when play is pressed)
       - animate = 1 (rotate immediately)
     - The default is for the dataset to start animating immediately
     - If you have the playlist running in auto run, then the dataset will start to animate immediately regardless of what is set
   - Setting the Tilt
     - You can set the tilt of the dataset along the x, y, and z axes.
     - We have many of our Earth textures set to load at a 23.5° tilt to resemble the actual Earth tilt
     - This is also a helpful function if you are viewing a dataset with information about the poles, which are hard to see without tilting the sphere
     - Simply set “tiltx,” “tilty,” and “tiltz” to the degrees that you want tilted
     - The tilt can be positive or negative
     - The default is no tilt
   - Animation Options for a Time Series
     - All of the animation options mentioned so far work for both textures and time series
     - There are many more options for time series
     - The rest of the options that we are going to cover can only be used with a time series
   - Dwelling on Frames
     - If there is a docent leading a presentation and they need some time to provide background information to an audience about what they are seeing then “animate = 0” is the best option
     - But if they just want a brief pause at the beginning of the dataset, then “firstdwell” is a good option

- The default is for a dataset to start animating immediately
- "firstdwell" allows you to define an amount of time (in milliseconds) that the system will stay on the first frame before animating
  - firstdwell = 4000 (dwell on first frame for 4 sec.)
- It is also good to dwell on frames so the audience has time to absorb what they are looking at
- In addition to "firstdwell," there is also "lastdwell," which dwells on the last frame
- Datasets automatically loop, so it's nice to set "lastdwell" so that there is a pause before the dataset goes back to the beginning.

➢ Stopping the Animation
- To stop an animation you can simply press the "A" button on the remote
- But if you want to stop on an exact frame, then you should use "stopframe" in the playlist
- This lets you set an exact frame that you want the animation to stop on and start animating again after you press play
- This is a good feature to use with model data when you want to look at a particular year

➢ Shortening a Dataset
- If you only want to show a piece of a dataset you can adjust the frames that the dataset starts and stops on.
- For instance, if we only want to show Hurricane Katrina and not the whole hurricane season, we set the "startframe" and "endframe" to be the frames that contain Katrina
- The "endframe" can be a negative number that counts back from the end
- Another way to shorten a dataset is to use "skip," which allows you set a skip factor
- When "skip = 1" then every other image is skipped, when "skip = 2" every third image is skipped, …

➢ Rotating and Animating
- By setting "zrotationenabled = 1" you can not only have a dataset animate, but also rotate
- When "zrotationenabled = 1" then you can also set the "zfps" and "zrotationangle" to control the rotational rate and angle
- Make sure that you set a "zfps" that gives your audience plenty of time to grasp what is happening before it rotates out of view

➢ Auto Run
- Auto run mode cycles through the datasets in a playlist automatically, showing each dataset for a specific amount of time
- If not specified, each dataset is shown for 180 seconds
- You can change this by setting "timer" in the playlist.sos file
- It's important to set the timer if you are using audio tracks that are synced to the datasets

➢ Audio with SOS

- Audio tracks are nice to have when the sphere is on auto run so that the audience can hear about what they are looking at
- The NOAA library has a limited number of audio tracks available.
- The audio tracks can be in any format that is compatible with the Linux MPlayer such as:
  - .mp3, .mp4, .wav or .ogg
- Use the "audio" keyword in the playlist to point to the location of the audio file

4. Picture in a Picture

➢ PIP Information

- Picture in a picture (pip) allows you to display pictures or videos (mpeg4 only) on top of any dataset
- This feature is commonly used to display color bars, charts, graphs, and supplemental images for a dataset
- It can also be set to display a logo or any other image you want
- You can have multiple pip's in a dataset that either appear all at once, or play like a slide show
- The pictures that you are going to be used as pip's can be stored in the same folder as the dataset
- When you include a pip there are several options that you have to set

➢ PIP Options

- "pip" defines the picture or movie to be used as the pip
- There are three different styles for pips
  - Projector, room, globe
- The default is "projector" - the pip appears in the center of each projector view (pip appears four times)
- "room" – the pip appears once on the globe at a specified latitude and longitude relative to the room and does not move as the sphere rotates "globe" – the pip appears once on the globe at a specified latitude and longitude relative to the globe and does rotate with the sphere
- Use "pipstyle" to specify the style of the pip, default is "projector"
- If you want to adjust the position of the pip, use "piphorizontal" and "pipvertical"
- Both of these are specified by degrees where east of the projector and north of the equator are positive
- Be careful not to move an image to far north or south as warping become more apparent close to the poles
- An alternative to using "pipvertical" and piphorizontal" is to use "pipcoords," which is set in degrees latitude and longitude
- The benefit of using "pipcoords" is that there is no warping of the images, even near the poles.
- "pipalpha" sets the transparency of the pip. When it is partially transparent you can still see the rotation of the dataset below the pip

- "piptimer" is how long the pip will be displayed, when set to 0 the pip is displayed for the duration of the clip
- "pipwidth" and "pipheight" define the height and width of the image in degrees of latitude and longitude. It is important to know the proportions of the pip so that you can make sure it's the right size on the sphere
- "pipfadein" and "pipfadeout" are the number of seconds it take the image to fade in and out of view. Default is 0
- The time set in "piptimer" excludes the fade in and out time
- "pipdelay" delays the appearance of the pip by the specified time in seconds
- "pipfps" is used to set the frame rate of an mp4 pip

5. Labels and color bars

- Using Color Bars and Labels
  - While color bars and labels can be added directly to the images that you create, it is not recommended
  - You can externally add the color bars and labels, which adds flexibility and convenience
  - If they are part of the image, then make sure that they are sized appropriately for the sphere and positioned so that they don't warp too much
- Color Bars
  - Color bars are added as pips
  - We typically save them as color_bar.jpg in order to keep them separate from other images
  - Make sure that color bars are big enough that they appear clear on the sphere
  - If you include units, those need to legible on the sphere
  - We prefer vertical color bars, but it's up to your site how you make your colorbars
- Labels
  - Labels are just a simple text file that we name labels.txt
  - In the text file, there is one line for each image in the time series
  - Labels typically include the date and maybe a name or model run
  - You can make the labels using any text editor that you prefer
- Label Position
  - The default position of the labels is
  - (-0.3, -0.5)
  - The position of the labels can be changed by using "labelposition," which is set by the x and y position as a pair of coordinates (x,y)
  - X and Y can vary from -1 to 1
  - Negative is south of the equator and west of the projector
- Label Options
  - The default color of the labels is white, but that can be changed using "labelcolor"

- "labelcolor" can be R, G, B, Alpha, or the symbolic names: white, black, red, green, blue…
- If "label = default" then the image file names are used as the labels

➢ Labels and Titles
- Titles can be included as part of the labels
- If you want more font, color and size options then you can include the title as a pip

6. Adding New Datasets

➢ Find a place to store the new dataset on the control computer and make a folder
➢ Put all of the data related to the dataset into the folder, at very least you need the images and a playlist.sos file
➢ Make sure that the playlist.sos file is written correctly because this is what the SOS Stream GUI uses to load the dataset on the sphere
➢ List the category of the new dataset in the playlist.sos file. This tag is used to populate the library in the SOS Stream GUI
➢ To view the dataset either create a playlist that contains it, or update the library and find it in there

7. Sharing Datasets

➢ As sites make new datasets, it is our hope that they will share them with NOAA so that we can distribute them to all of the SOS sites
➢ In addition, the NOAA library is constantly growing as more scientists provide us with data
➢ Collaboration between sites to make new datasets together is encouraged and recommended